Trout Lake GNA – Implementation Overview

Desired End Result: The Trout Lake project has three main goals:
1) Reduce stand density to improve forest health and mitigate current insect and disease threats.
2) Reduce hazardously high fuel loads to protect local communities and surrounding land from wildfire.
3) Create landscape-level connectivity between nearby projects with similar restoration treatments.

Planned treatments will use variable density thinning and regeneration harvest to restore spatial heterogeneity and open stand conditions within the project area. Preference will be given to the most vigorous ponderosa pine, western larch, and Douglas-fir, with the objective of increasing resistance to disturbance agents.

- LEAVE TREES:
  - Leave all live conifers ≥21.0" dbh
  - Desired leave tree species in order of preference: PP, WL, WP, DF.
  - In *RHCAs*, desired species in order of preference: PP, WL, WP, DF, RC, WH, and ES.
  - Target cutting all AF, ES, GF, LP, and RC <21" dbh outside RHCAs and clumping targets.
  - Leave tree health and vigor is just as important as species selection**.** Do not leave an unhealthy tree with higher species preference over a healthy, vigorous tree of lower **species preference** (within the list of desirable leave trees).
  - As safe, retain all snags 21+" dbh and 4-7 snags per acre 16+" dbh.

- STOCKING: Average stocking levels by unit are outlined in the Implementation Table.
  - You may vary the density throughout by up to 100% to select for the best (most desirable) trees. Don't worry about meeting stocking on every single acre; the stocking target is an umbrella for the entire unit. Focus more on tree selection.
  - **The listed stocking level does NOT apply to areas without enough suitable leave trees.**

- OPENINGS: You may create openings in areas without enough suitable leave trees under the following situations: (a) in areas of whitewoods and upland cedar; (b) areas with unhealthy trees; (c) areas with pre-existing, naturally occurring gaps. *Created openings:*
  - Shall not exceed 40 acres in size for areas with <12 tpa (seed tree, etc).
  - Shall retain the Most Desirable trees where available (up to 20 tpa).
  - For areas over 40 acres needing shelterwood (12-20 tpa), contact FS Silviculturist James Pass.

Special Objectives:

- **Aggressive aspen enhancement:** Within 100 feet (± 20%) of an aspen clump, leave only mandatory trees (Section I.A) and PP/WL trees that are mistletoe free and have ≥50% live crown ratio.
- **Low dwarf mistletoe tolerance:** Most Desirable leave trees will be free of dwarf mistletoe. Less Desirable leave trees are permitted a Hawksworth dwarf mistletoe rating of 1 on a unit-by-unit basis (see Implementation Table).
- **Clumping targets:** Clumping targets for large clumps (20 trees/clump, ±10 trees) will be given on a unit-by-unit basis. Any tree species is permissible to leave in order to form a clump. Clumps should be placed in topographically appropriate locations, such as moist swales and RHCAs.

Table 1. Implementation table – see pgs. 3-4 for detailed specs

1	2	3	4	5
Unit Number	**Acres**	**Specifications**	**Unit Notes / Special Conditions**	**Average Residual Stocking Level**
All	All	**Diameter cap:** All trees ≥21.0 inches DBH or 32.0 inches stump diameter shall be left standing. **Suitable trees:** PP, WL, WP, DF with desirable characteristics as described in Section III. **Unsuitable trees:** Take all unsuitable trees as defined in Section III. All AF, ES, GF, LP, RC are unsuitable outside of the RHCA and clumping targets. **Snags**: as safe, leave all 21+" dbh snags and 4-7 snags 16+" dbh.	See Section IV. **A. Aspen:** within 100 feet (±20%) of an aspen clump: take all conifers <21" dbh except PP/WL free of dwarf mistletoe and with ≥ 50% live crown ratio. **A. RHCA:** leave 50-70 TPA (about 25-30' spacing). Desired species in order of preference in RHCA: PP, WL, WP, DF, RC, WH, ES. **C. Clumping target:** Leave target number of large clumps. Large clumps can include any species.	Section II describes conditions where the stocking level does not apply and when to leave the low or high end. Follow the tree selection criteria in Section III. **Variability:** Variable spacing of leave trees is desired.
1	187	Do not leave any trees with dwarf mistletoe (DMT)	B. RHCA C. Clumping target: 10 large clumps Look to retain healthy WL. Limit clump placement to area near creek. Incorporate large, old trees near creek into clumps.	20-60 ft^2 BA/ac -or- 20-50 TPA
2	124	Do not leave any trees with DMT	A. Aspen	20-60 ft^2 BA/ac -or- 15-40 TPA
3	377	Do not leave any trees with DMT	A. Aspen B. RHCA Apply aspen enhancement prescription to cottonwood trees as well. Watch for large remnant trees at the eastern end of the unit.	20-80 ft^2 BA/ac -or- 15-60 TPA
4	275	Cut all DF <21" dbh	Generally, leave most of the PP and most of the WL with a Hawksworth DMT rating of 1 or less. Armillaria root rot pockets throughout stand.	20-40 ft^2 BA/ac -or- 15-30 TPA
5	939	Cut all DF <21" dbh. Do not leave any trees with DMT.	A. Aspen B. RHCA	20-40 ft^2 BA/ac -or- 15-30 TPA
6	351	Cut all DF <21" dbh.	B. RHCA Look to open up areas around large PP/WL.	20-40 ft^2 BA/ac -or- 15-30 TPA
7	289	NA	A. Aspen B. RHCA C. Clumping target: ~50 large clumps If large PP found in unit, thin heavily around them to reduce fuels and improve vigor.	20-80 ft^2 BA/ac -or- 20-60 TPA

Leave Tree Guidelines

-This info supports the implementation table-

I. Leave Trees to Remain in the Unit:

A. ALL mandatory leave trees: 1) live trees with a DBH ≥ 21.0", or a stump diameter of 32.0" inches when measured at 4 inches above the ground on the high side of the stump; 2) hardwood trees; and) western white pine.
B. Additional live trees between 5.0" DBH and 21.0" DBH to meet the specifications in the Implementation Table.
C. Snags: where safe and outside of firewood areas, leave an average of 4-7 dead trees per acre >16" dbh.

II. Stocking Level

A. Stocking level is variable and is based on tree selection.
   1. High end of the Stocking Level: Leave all available Most Desirable (III.A) trees up to the high end of the Stocking Level.
   2. Low end of the Stocking Level: When Most Desirable trees are not available to meet the low end of the Stocking Level, leave the healthiest Less Desirable (III.B) leave trees up to the low end of the Stocking Level.
   3. Areas below the Stocking Level: Do not leave Unsuitable trees. The Stocking Level does not apply to:
      - Areas that do not have enough suitable leave trees to meet the low end of the Stocking Level; in these areas leave the available suitable trees.
      - Aspen enhancement areas described in Section IV.A.

B. Other specifications applying to the Stocking Level:
   1. Mandatory leave trees count toward the Stocking Level.
   2. For areas with small leave trees (<12" dbh), switch to spacing instead of basal area to provide for operability. Space at least 25' between individual trees and clumps.
   3. Created openings (areas with <12 tpa) up to 40 acres in size are allowable provided Suitable trees are retained as available.
   4. Compliance checks will measure using a 10 BAF.

III. Tree Selection: Suitable and Unsuitable Leave Trees

A. Most Desirable Leave Trees/Suitable: Trees that possess the following characteristics shall be the first choice for desirable leave trees:

1. Desired species, in order of preference: PP, WL, WP, and DF. Desired Species changes in RHCAs, see Section IV.B.
2. Healthy trees, exhibiting good vigor/growth. Use Figure 1 to help assess crown health.
   - Live crown ratio is 30% or higher.
   - Abundant foliage with good color; generally dark green in color foliage except for WL/WP.
   - Height-to-diameter ratios <100 (not overly tall and skinny).
   - Free of severe dwarf mistletoe (see Figure 2).
   - Free of severe insect or disease problems.
   - Free of Major Physical Damage: these trees either have no physical damage or minor damage such as a basal scar or severed roots on less than 1/4th of the circumference of the bole and on less than 3 feet in length.

B. Less Desirable Leave Trees (also suitable): When the low end of Stocking Level cannot be achieved with trees that possess the most desirable characteristics, select trees with less desirable characteristics in the priority listed below:

1. Desired species, same as for Most Desirable.
2. Healthy trees, same as for Most Desirable except for Less Desirable trees can have:
   - Low level of dwarf mistletoe: Hawksworth mistletoe rating of 1 or less.
   - Moderate physical damage: trees with *basal scar* or severed roots on less ½ the bole circumference that is less than 3 feet in length.
3. Up to 5 Wildlife Trees per acre having a dbh ≥ 16.0". Wildlife trees are live trees greater than 40% cull due to heart rot, broken tops, dead tops, and/or bird holes.

C. DO NOT LEAVE (Unsuitable):
The following trees <21" dbh shall not be left:

1. All RC, ES, WH, AF, GF, and LP where they are present outside of RHCAs or large clumps.
2. Unhealthy trees showing any of the following problems:
   - Severe insect/disease.
   - Trees with a Hawksworth mistletoe rating > 1.
   - Less than 30% live crown ratio (puff-top trees);
   - Sparse, fading or yellowing crown.
   - Tall and skinny trees (noodle trees) w/ height-to-diameter ratio of >1:100.
   - Major physical damage: Trees that have a basal scar or severed roots on more than half the bole circumference and more than three feet in length.
3. Conifers targeted for removal around aspen clumps as described in IV Special Conditions.

IV. **Special Conditions:** These conditions are identified in column 4 of the implementation table.

A. **Aspen enhancement:** the desired end result is a sparse, low density of conifers around aspen clumps so the aspen will sprout. Within 100 feet (+ 20%) of an aspen clumps:
   - Take all conifers <21" dbh except for PP/WL trees free of dwarf mistletoe and with >50% live crown ratio.
     - Note: the "A" trees in Figure 1 show an example of these PP/WL. These very healthy PP/WL are usually present at about 0-5 TPA.
   - An *Aspen Clump* is defined as having three (3) or more live aspen trees greater than 5.0 inches DBH with boles that are within 15 feet of each other.

B. **Riparian Habitat Conservation Area (RHCA):** the desired end result is to reduce ladder fuels and tree competition while maintaining shade and structure near streams; the RHCAs will appear denser than the treatment outside of the RHCA.
To achieve this:
   - Leave 50-70 TPA (± 10%). This averages about 25-30 foot spacing. However, note that spacing needs to widen when leaving clumps.
   - Follow the tree selection criteria in Section III while using the RHCA desired species list.
   - RHCA desired species in order of preference are PP, WL, WP, DF, RC, WH, ES, AF, GF, and LP.
   - Tolerance for RHCA distances from streams is ±10%.
   - It is acceptable and desirable to apply aspen treatments within the RHCAs.

C. **Clumping target**: the desired end result is to maintain spatial variability and to retain scattered patches of trees that include a variety species and size of tree.
   - Leave the specified number of large clumps for the unit as noted in the DxPre table.
   - Large clumps are made of 20 trees/clump (±10 trees).
   - Any tree species over 5" dbh can be used to make a clump and unsuitable trees can be used as well.
   - Disperse the large clumps throughout the unit based on desirable conditions and topography, including areas with ≥21" dbh RC/ES or moist swales and RHCAs.
   - Minimum spacing between large clumps is 30 feet. DO NOT form clumps around large PP/WL/DF.
   - Map general locations of the clumps using either a gps or paper map.

V. **Spatial variability**
General vision: Variable spacing of leave trees is desired since it enhances resilience to disturbances. Recent monitoring has highlighted that: 1) our treatments tend to have too many trees left as individuals and not enough trees in clumps of 5 or more trees; and 2) our treatments don't create enough open space between tree crowns. In other words, our leave trees are spaced too uniformly.

Provided below is a summary of historic reference conditions for spatial pattern. These are worth keeping in mind but are lower priority than achieving tree selection objectives.
   - About 20-40% of leave trees would be as individuals, 30-40% would be in clumps of 2-4 trees, and 20% would be in clumps of 5-9 and 10+ trees. The drier the site, the more trees would be left as individuals.
   - About 50% of the unit would have between 30-80 feet of space between overstory tree crowns.

Definitions

Abbreviations: TPA (trees per acre), PP (ponderosa pine), WL (western larch), DF (Douglas-fir), WP (western white pine), RC (western red cedar), ES (Engelmann spruce), GF (grand fir), WH (western hemlock), WP (western white pine), AF (subalpine fir), LP (lodgepole pine), QA (quaking aspen),PB (paper birch), Ac (acres), OS (overstory, generally ≥ 5.0" DBH), US (understory generally less than 5.0"DBH), DMT (dwarf mistletoe).

Aspen Clump: Three (3) or more live aspen trees greater than 5.0 inches DBH with boles that are within 15 feet of each other.

Basal Area: The cross-sectional area (sq ft) of trees, measured at DBH.

Basal Scar: An injury to a tree where there is a missing bark such that the injury is in contact with the ground. Examples include cat faces from fire and equipment damage at the base of the tree bole.

Clumps: Two or more leave trees with boles within 15-20' of one another.

Created openings: Areas over 5 acres in size where harvest leaves fewer than 12 TPA in the overstory, up to 40 acres in size.

Hawksworth Mistletoe Rating: Divide the crown of the tree into 3 sections. Rate each section for presence of mistletoe. The sum of the sections equals the Hawksworth Mistletoe Rating. Figure 2 provides an example.

Height to Diameter Ratio: The relationship between height and dbh. Trees that are overly tall for their diameter size generally have a poor height to diameter ratio. These trees usually bend over once nearby trees have been removed. Example: A 50' (600") height and 6" DBH is a 100:1 ratio.

Large PP: large ponderosa pine trees ≥ 21.0" DBH.

Live Crown Ratio: the ratio of crown length to total tree length.

Riparian Habitat Conservation Areas (RHCAs): areas where riparian-dependent resources receive primary emphasis, and management activities are subject to specific standards and guidelines. RHCAs include traditional riparian corridors, wetlands, and intermittent streams. There are four categories of stream or water body

- **Category 1 – Fish-bearing streams**: 300 feet slope distance on both sides of stream channel.
- **Category 2 – Permanently flowing non-fish-bearing streams**: 150 feet slope distance on both sides of stream channel.
- **Category 3 – Ponds, lakes, and wetlands greater than 1 acre**: 300 feet slope distance on both sides of water body.
- **Category 4 – Seasonally flowing or intermittent streams, wetlands less than 1 acre, landslides, and landslide prone areas**: 50 feet slope distance on both sides.

Severe insect or disease problems:

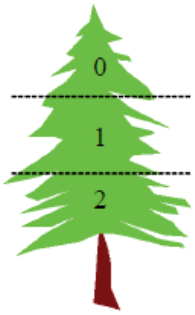
- **Dwarf mistletoe** – Trees with dwarf mistletoe in more than half the crown Hawksworth rating 2 or greater). Brooms, cankers, and swellings on stems and branches are indicators of mistletoe. Mistletoe is common in western larch and Douglas-fir. Epicormic branches are not to be confused with dwarf mistletoe.
- **Root disease** – Trees showing symptoms of root disease should be removed. Frequently, these trees are Douglas-fir near root disease patches (an area of dead, broken off trees). Indicators of root disease include a white fungus growing between the bark and the wood, resin flow at the base of the tree and/or a lighter color crown with fewer needles, (when compared to other Douglas fir in the area) and fading crowns and/or sap flow from the bole of Douglas-fir, grand fir, and subalpine fir.
    - A*rmillaria root disease patch*: Armillaria disease centers are typically seen in Douglas-fir or true fir stands of uniform age and density. Patches are strikingly round or oval. Patch centers usually contain broken-off snags, advanced conifer regeneration, and/or a hardwood/brush component. The size and age of regenerated trees declines toward the margins of the patch where an increasing number of standing dead trees are seen. In the margins, recently dead trees are mingled with thin-crowned, dying trees and those showing little or no apparent decline.
- **Blister rust** – Symptoms of blister rust include heavy resin flow on the stem from a diamond shaped wound, dead branches and/or a dead top. Blister Rust is common in western white pine.
- **Scolytus** – Grand fir or subalpine fir with scolytus scars on both sides of the tree.
- **Bark beetles** – Numerous pitch tubes where beetles have bored into tree. Symptoms of mountain pine beetles are small red to yellowish pitch tubes (less than one-fourth inch) and boring dust in bark crevices around the base of the tree.

Vigor/Growth: Relative health and growth of forest trees. Leave-tree preference shall favor trees possessing relatively high vigor/growth, free of disease and defect, over trees with relatively poor vigor and growth, regardless of leave-tree species preference. For example, a WL with a relatively healthy crown will be favored over a similarly-sized PP with an unhealthy crown (i.e. faded, yellowing). But, if the two trees possessed similar vigor/growth characteristics, then the PP shall be the preferred leave tree.

Figure 1. Tree selection Aid. Artwork by Robert Van Pelt 2008.

	DESIRABLE LEAVE TREES	**UNHEALTHY TREES**
Ponderosa pine		
Western larch		
Douglas-fir		
NOTE: use this artwork along with other characteristics as an aid to judge vigor and crown health.		

Figure 2. Hawksworth dwarf mistletoe rating system. This example has a Hawksworth Rating of 3.



Hawksworth Mistletoe Rating

- Divide live crown into thirds
- Rate each third separately. Each third should be given a rating of 0, 1, or 2 as described below:
  - (0) No visible infections
  - (1) Light infection, ½ or less of branches infected
  - (2) Heavy infection, more than ½ of branches infected
- Add ratings of thirds to obtain rating for total tree.